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(71) Applicant (for all designated States except US): THE WHITAKER CORPORATION [US/US]; Suite 450, 4550 New Linden Hill Road, Wilmington, DE 19808 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): MURAMATSU, Hidenori [JP/JP]; 71-35, Setogaya-cho, Hodogaya-ku, Yokohama, Kanagawa 240 (JP). UMEZAWA, Hiroyuki [JP/JP]; Room 410 Winzaimu, 1-14-39, Kamiaoki, Kawaguchi, Saitama 333 (JP). HANDA, Hiroto [JP/JP]; 3-4-1, Matsubara, Utsunomiya, Tochigi 320 (JP). HAMADA, Makoto [JP/JP]; 5-1-20-106, Uchiya, Urawa, Saitama 336 (JP).

(74) Agents: ABERLE, Timothy, J. et al.; The Whitaker Corporation, Suite 450, 4550 New Linden Hill Road, Wilmington, DE 19808 (US).

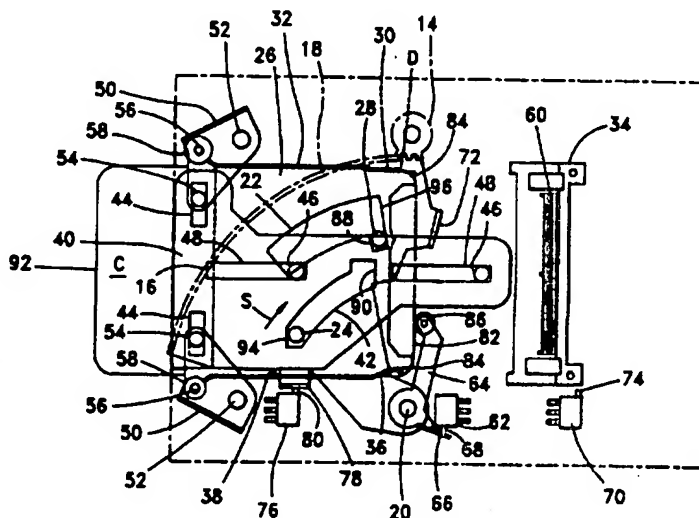
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(54) Title: ELECTRICAL LOADING/UNLOADING UNIT FOR CARD MEDIA

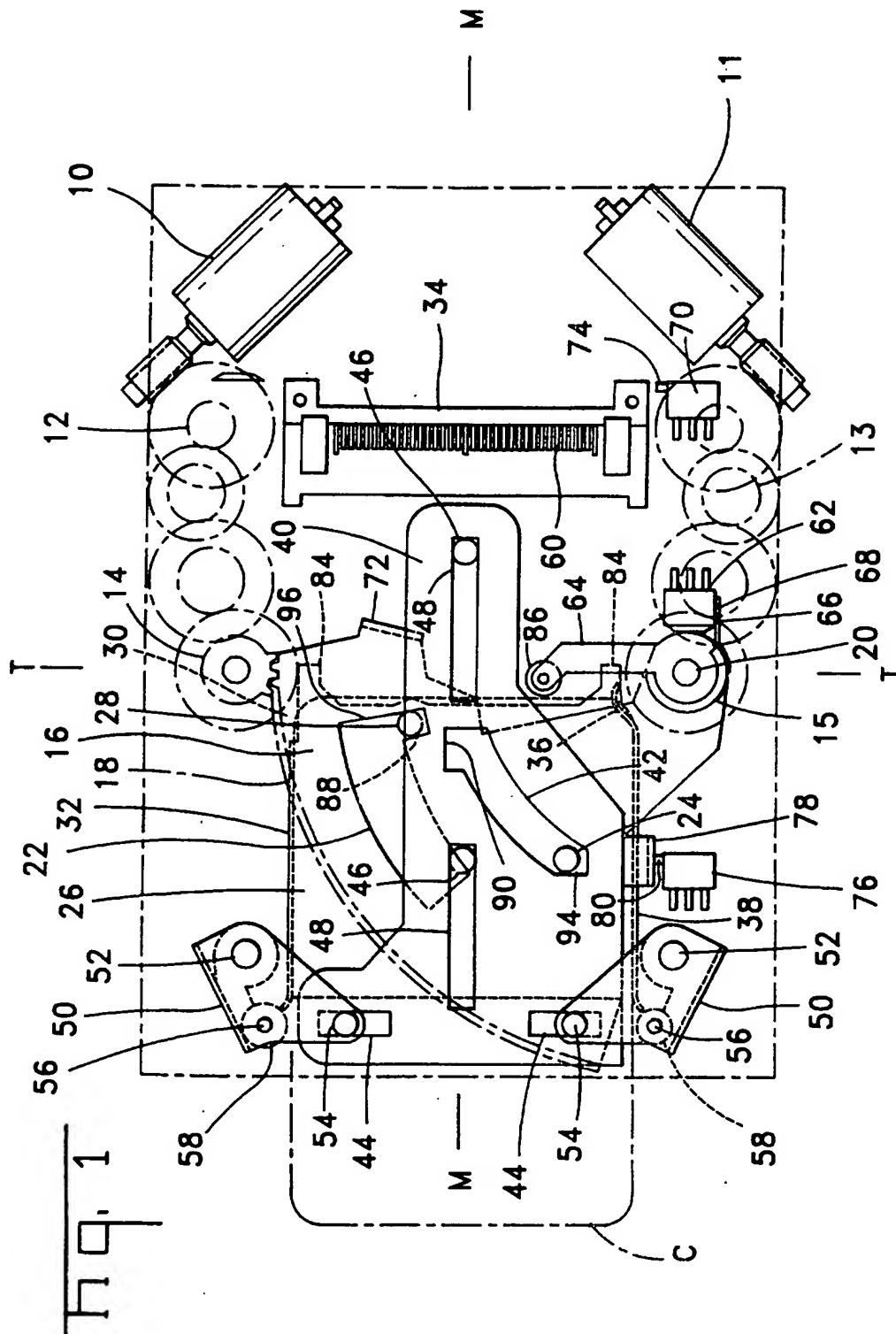
**(57) Abstract**

**Object:** to provide a loading/unloading unit of IC cards to stacked dual connectors in a read/write device. **Construction:** when an IC card C is going to be inserted (loaded) into a card holder (26), the unit is activated by a switch (S1) (62). A driving cam (16) moves the card C near the connector (34) along with the card holder (26) by pivotal movement in the direction of an arrow S. Then, the slider (40) in the direction of an arrow R to pivot the plugging arms (50) to push the trailing edge of the card C by rollers (58) for making connection to connection pins (60). The ejection (unloading) of the card C is performed by inversely pivoting the driving cam (16). The slider (40) moves in the opposite direction to move the plugging arms (50) away from the card path. Then, the action pin (28) pushes to move the card holder (26) to a location where an operator can grab the card for removal.

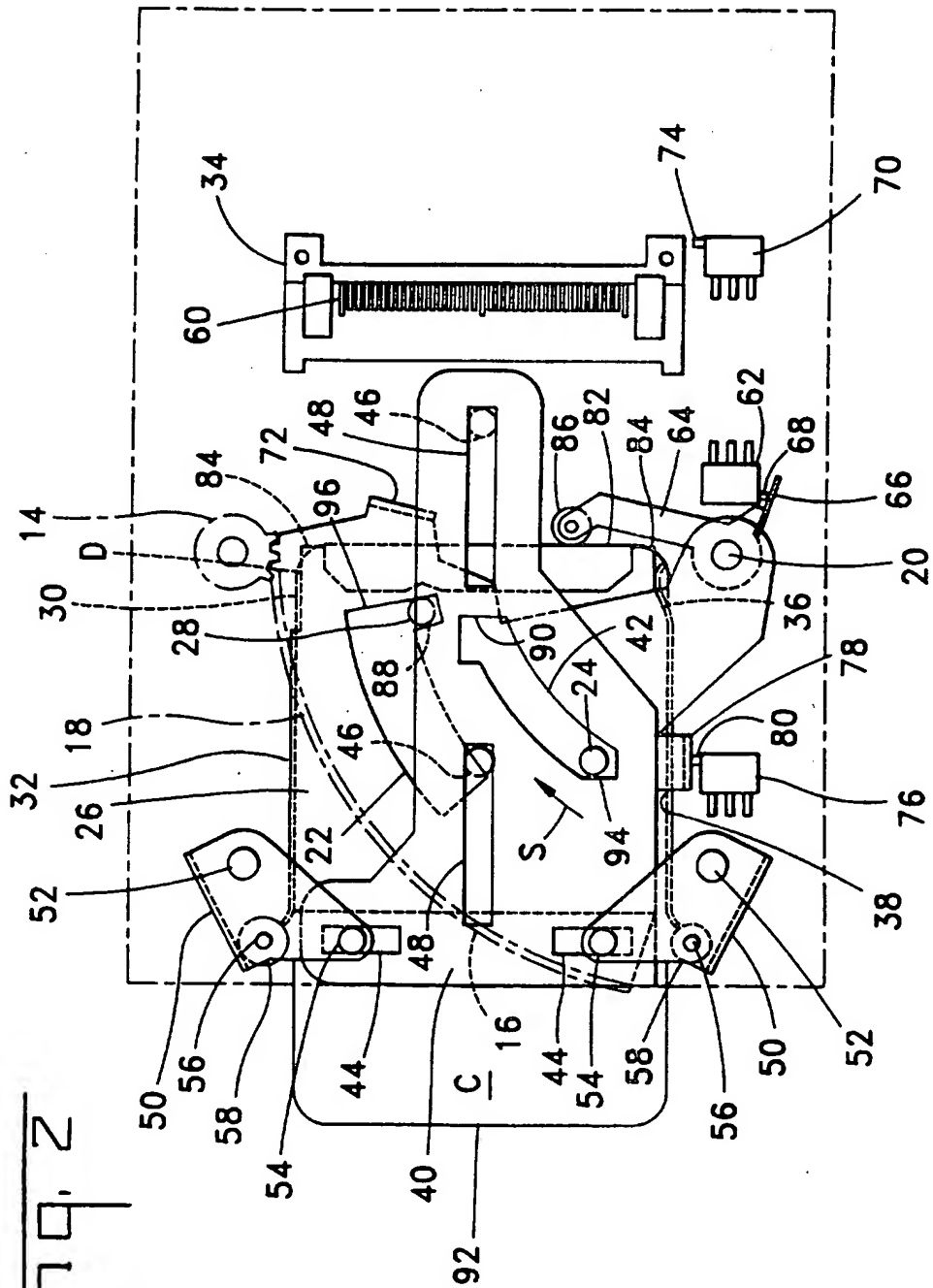
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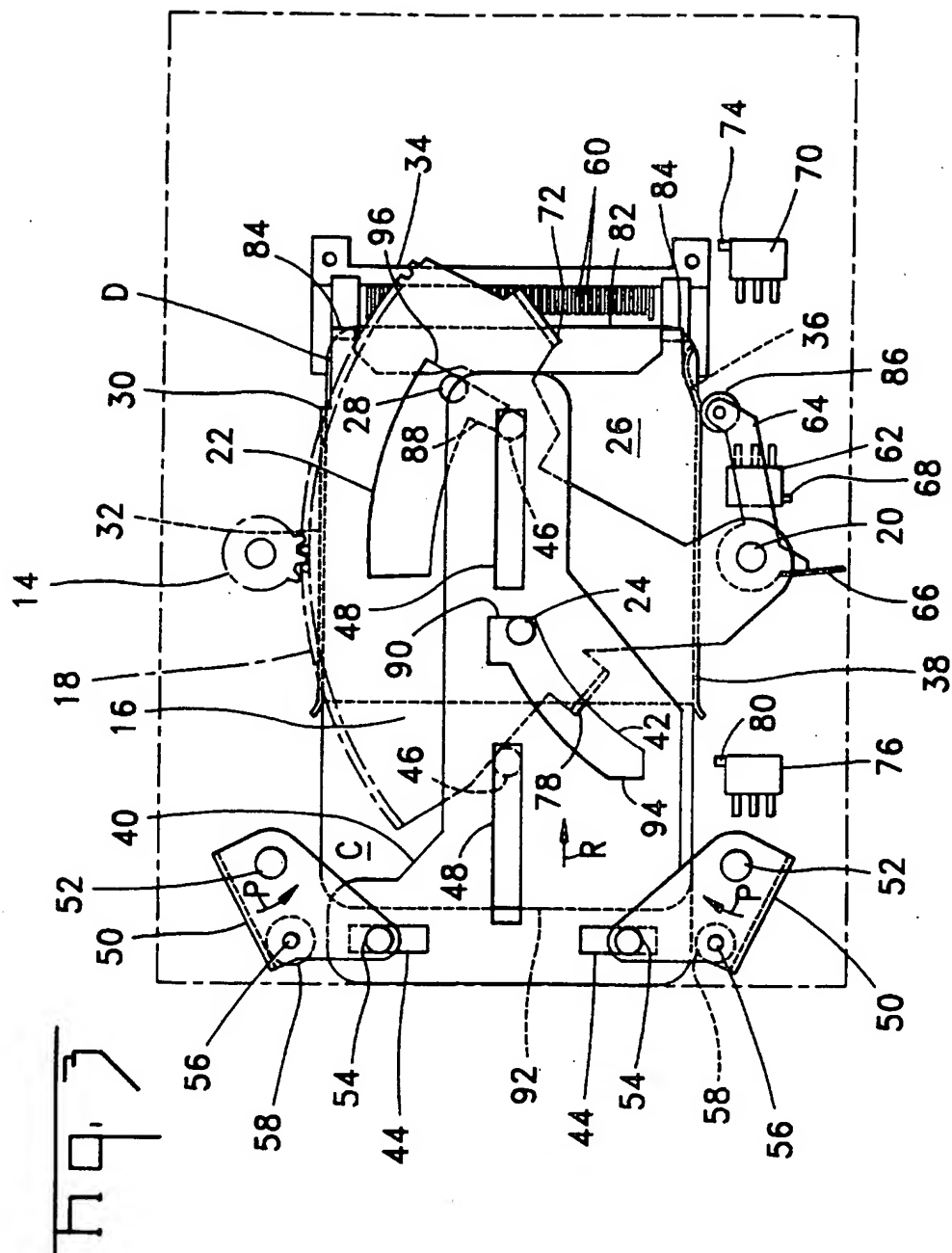
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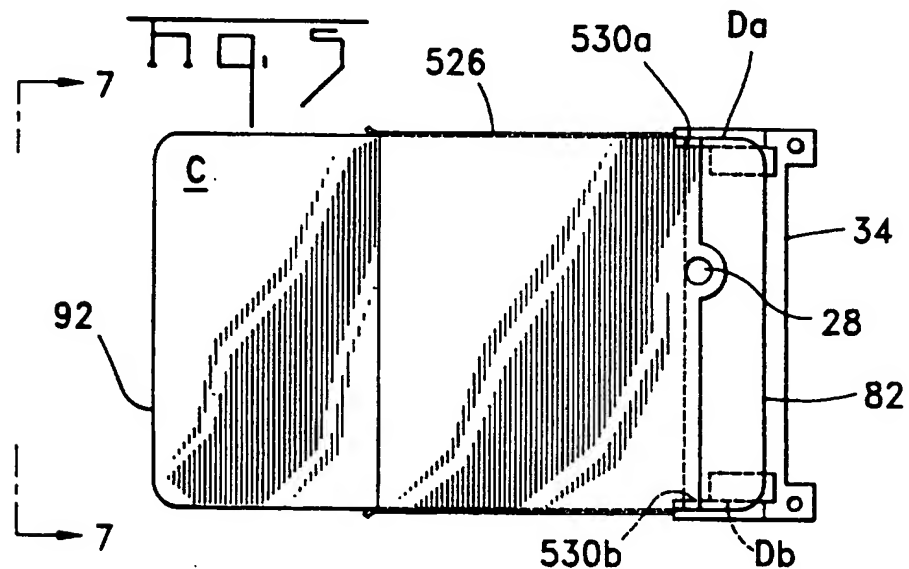
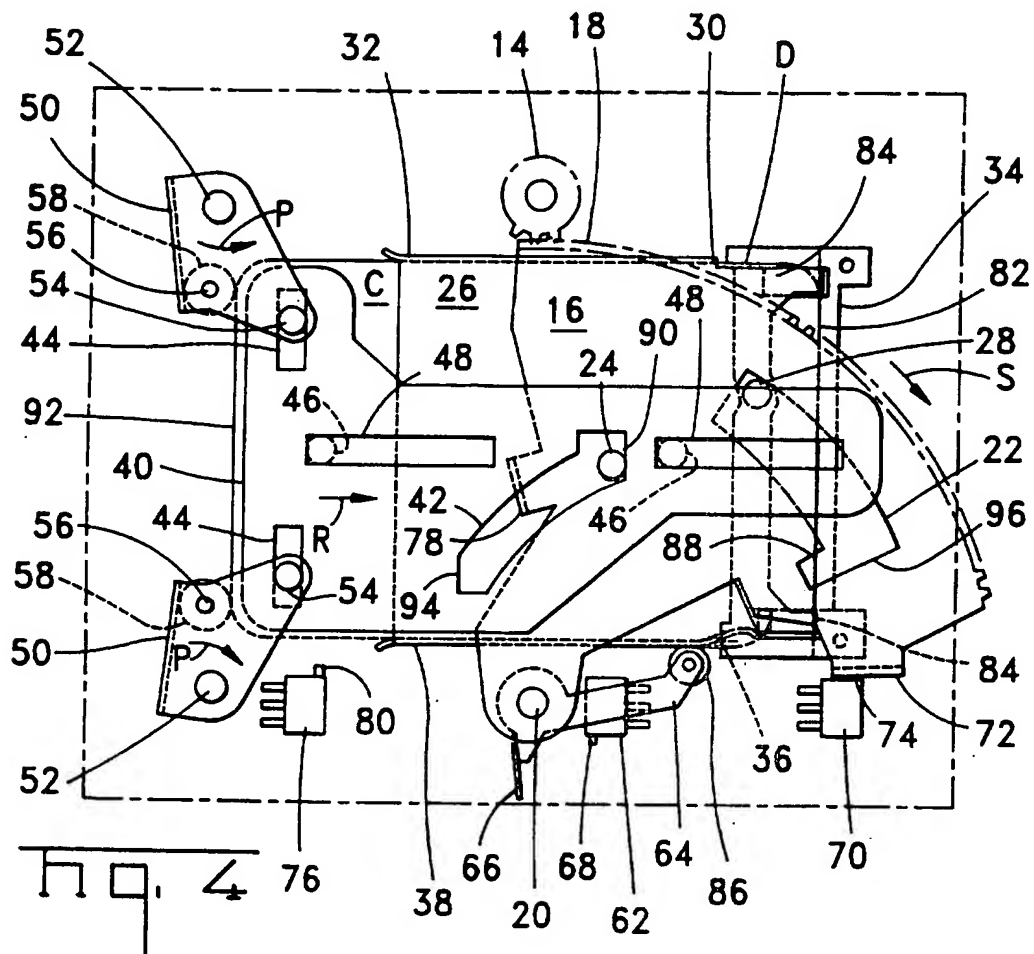
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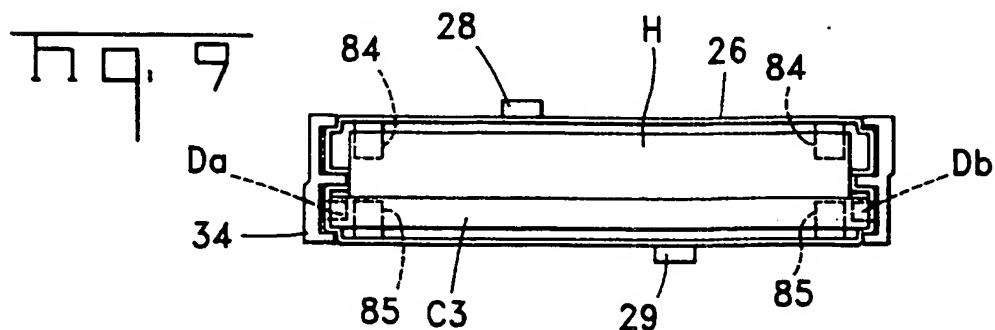
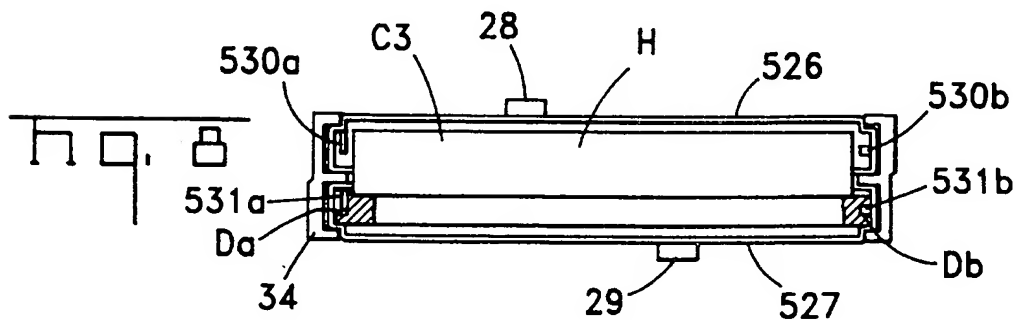
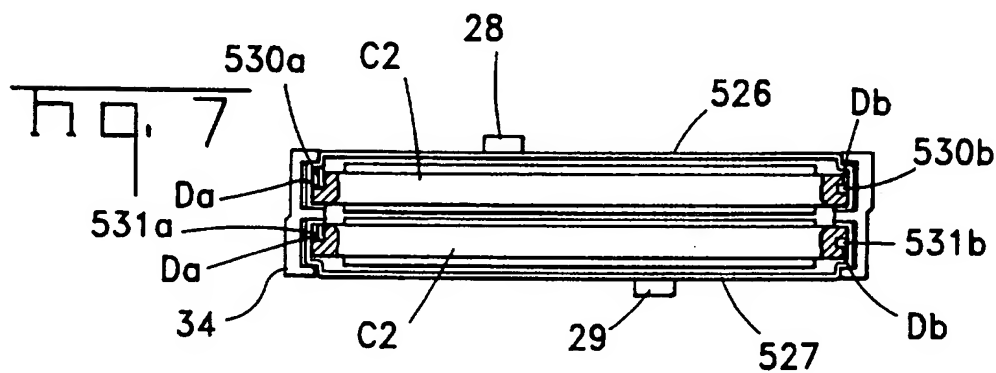
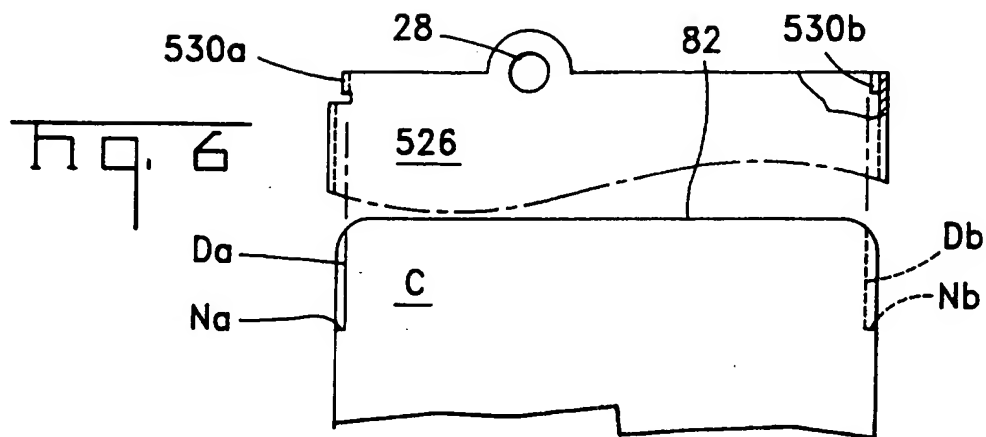
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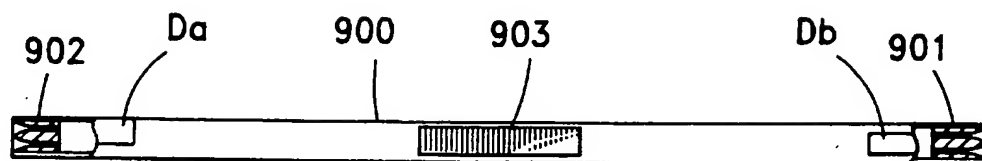


Fig. 10

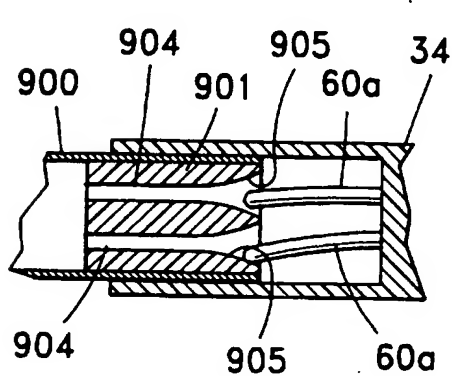


Fig. 11

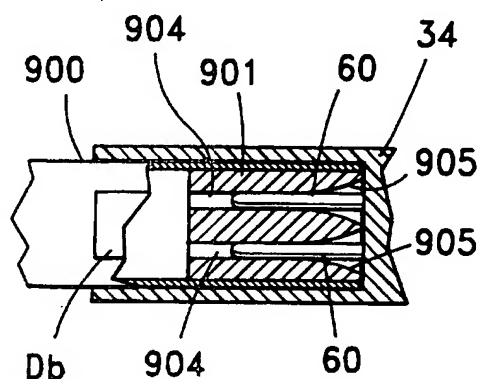


Fig. 12

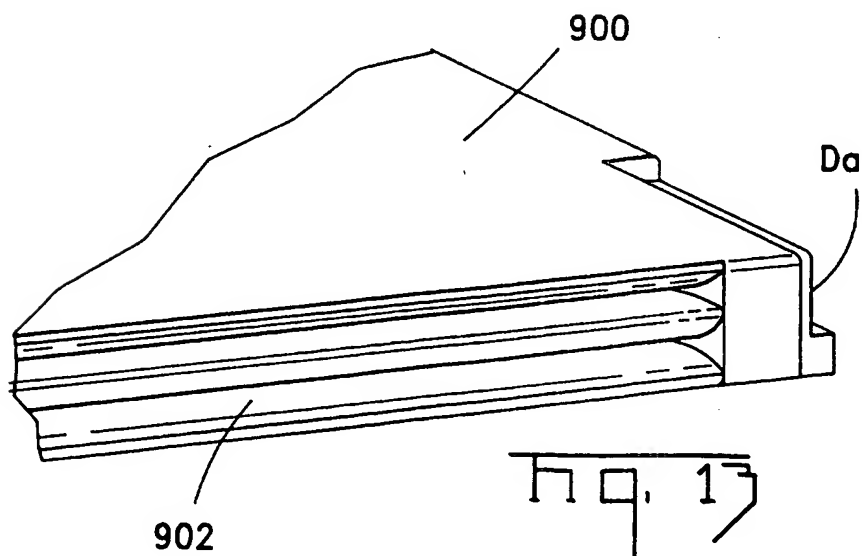
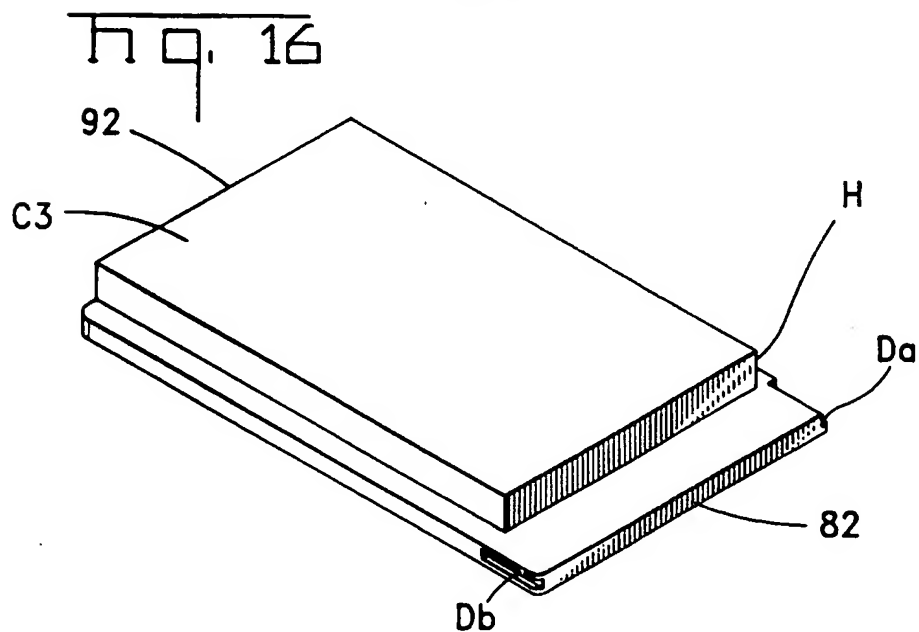
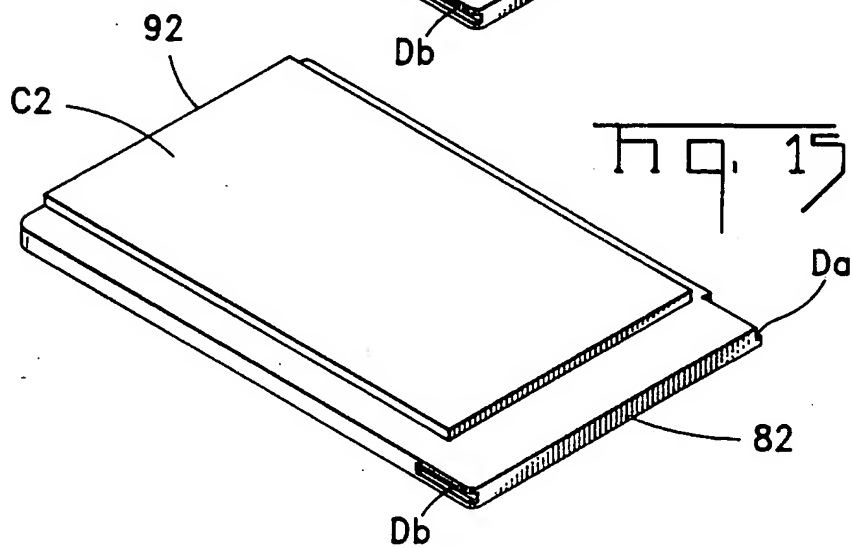
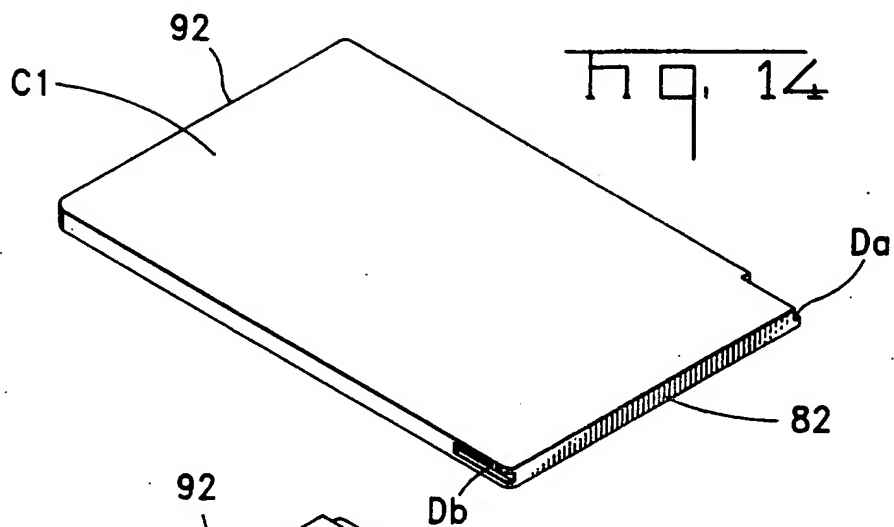


Fig. 13

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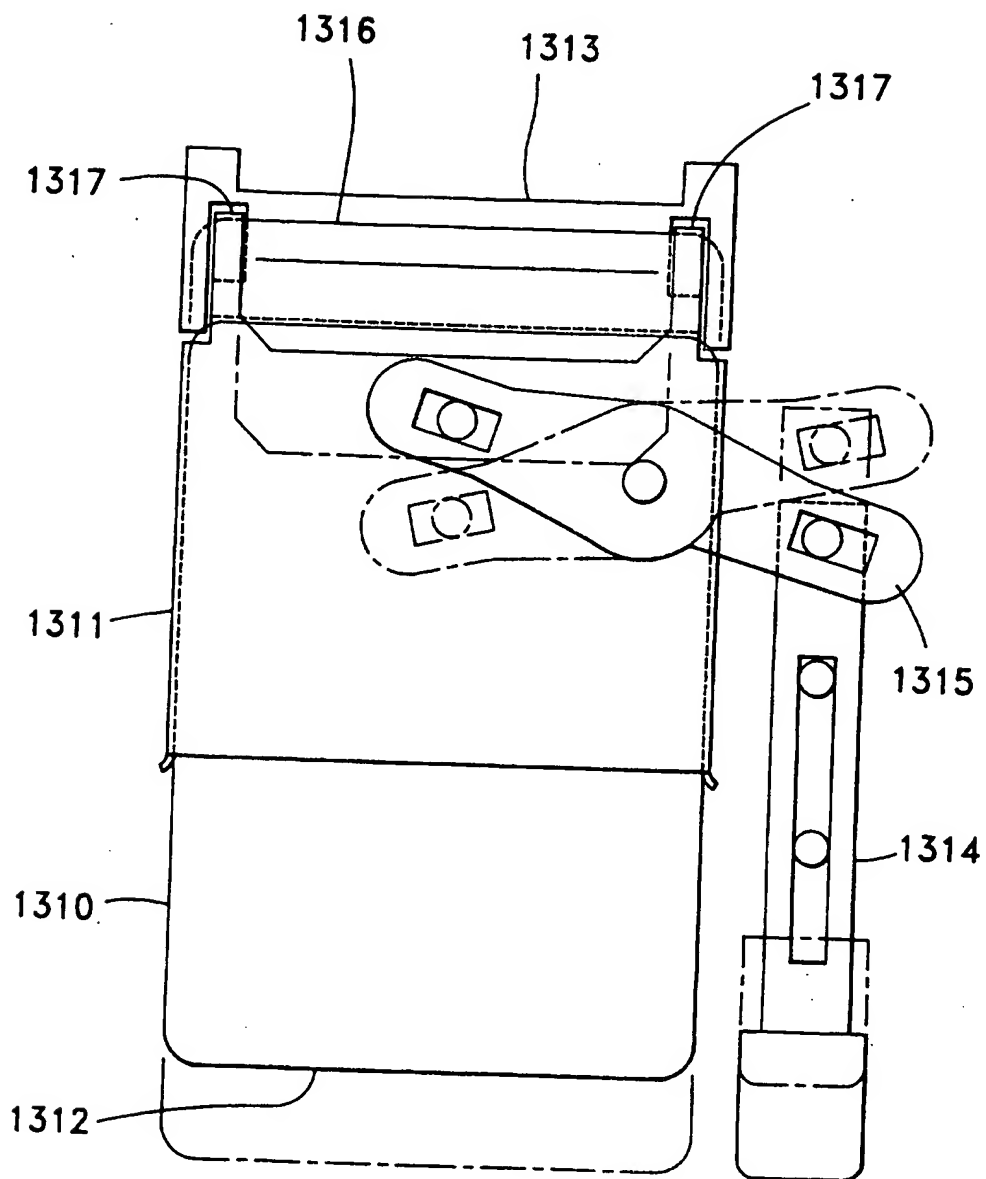


Fig. 17

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## INTERNATIONAL SEARCH REPORT

International Application No  
PC1/US 96/05034

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 G06K13/08

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	FR,A,2 623 928 (NHK SPRING) 2 June 1989 see abstract; figures 1,2 ---	1,2 5
Y A	EP,A,0 167 356 (TOKYO TATSUNO) 8 January 1986 see the whole document ---	1,2 3,8,10
A	US,A,5 332 891 (TOGAWA) 26 July 1994 see the whole document ---	4,8,11, 12
A	US,A,5 316 488 (MOLEX) 31 May 1994 see the whole document ---	7
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☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Forlen, G

**ELECTRICAL LOADING/UNLOADING UNIT FOR CARD MEDIA****SPECIFICATION**

5

**TITLE OF INVENTION**

Electrical Loading / Unloading Unit of Card Media

10

**DETAILED DESCRIPTION OF INVENTION****(Field of Invention)**

15 The present invention relates to an apparatus for electrically connecting a card media having connection pin holes disposed along one edge thereof to a mainframe of a data processing machine such as a personal computer, more specifically to a unit for loading and unloading an IC memory card having built-in ICs for  
20 storing/processing data to a connector in a read/write apparatus.

**(Prior Art)**

25 Conventionally, cards to be loaded or installed in a personal computer and the like can be classified into 3 types of identical planar size but different in thickness as shown in FIG. 12. Also, it is normal to use a manual loading/unloading mechanism of such cards by a planar operation as shown in FIG. 13.

30

Illustrated in FIG. 13 is a plan view of the loading/unloading (or ejection) mechanism. An operator loads (or insert) a card 1310 into a card holder 1311. Pushing the trailing edge 1312 of the card 1310 by a  
35 finger will plug the card 1310 to a connector 1313 along with the card holder 1311.

If it is desired to unload (or eject) the card 1310, an operator pushes a slide lever 1314. The slide  
40 switch 1314 is ganged with the card holder 1311 by way of an ejection arm 1315 to move the card holder 1311 in the ejecting direction as shown by a double-chain line in FIG. 13. At this time, engaging sections 1317 of the

card holder 1311 bent in such a manner to engage the leading edge 1316 of the card will bear the leading edge 1316 of the card to push in the ejecting direction.

5           In recent years, IC cards find wide applications as storage (memory) media for computer related equipment. Memory capacity of such IC card is increasing each year in accordance with technological development. This means that large amount of data stored in such IC cards  
10           are important property to companies and individuals using computers.

**(Problems to be solved by the Invention)**

          Unfortunately, however, such conventional manually  
15           operated loading/unloading unit for IC card (referred to simply card hereunder) can be operated at any time even reading or writing operation of signals in and out of the card, which may cause a damage in the stored data. Also, when the card is stolen, the data stored in the  
20           card is unprotected.

          Additionally, there needs a relatively large force to be applied to the card when loading or unloading the card to the connector. However, no card has a recess or  
25           projection for this purpose and the card must be pushed at the trailing edge in order to load the card into the connector.

          A manual operation may apply undesired biased  
30           forces or stress to the card during extraction, thereby requiring increased force as the number of extractions increases until ultimately damaging the card. It is therefore an object of the present invention to provide a compact, light weight, simple and less expensive unit  
35           to electrically load/unload the card into and out of stacked connectors.

**(Means to Solve the Problem)**

          In order to solve the above problem, the electrical  
40           loading/unloading unit according to the present invention is a card loading/unloading unit in a card read/write device, comprising a card holder slidable in the moving direction of the card and having support

projections to abut against the edge of the insertion (leading) end of the card to be inserted and retention means to retain the card, a card plugging arm pivotally disposed near the loading/unloading mouth of the card, a  
5 slider slidable in the moving direction of the card and engaging said plugging arm, a driving cam engaging said card holder and said slider, and an electrically driving member controlling said driving cam.

10 The plug arm is disposed at each side of a moving path of the card and pivotable about a rotary shaft perpendicular to the plane of the moving path, and engageable with the card by providing a roller rolling about an axis parallel to the rotary shaft. The card  
15 holder has a torsion spring as the card retention means to hold the card by extending into the card holder.

The driving cam has a rotary shaft at one side of the moving path to rotate by mating with a pinion having  
20 electrically driven teeth at the other side of the moving path. The rotary shaft and the rotary shaft of the pinion are disposed symmetrically at both sides of the centerline of the moving path at the center portion of the unit. the read/write device is provided with  
25 stacked connectors, the rotary shaft of the driving cam associated with one connector is coaxial with respect to the rotary shaft of the pinion associated with the other connector.

30 The card holder is provided with a reference projection insertable into a wrong insertion protection groove at the leading edge of the card at the upper stream of the support projections with respect to the insertion direction of the card. Preferably, normal  
35 insertion detection means is provided to actuate when the wrong insertion protection groove in the card inserted into the card holder and the reference projection match, and when the edge of the leading end of the card abuts against the support projections. The  
40 normal insertion detection means may be a switch ganged with an actuation arm pivotable about a rotary shaft supported coaxially with the rotary shaft of the driving cam. Preferably, the reference projection of the card

holder insertable into the wrong insertion protection groove at the leading edge of the card may act as a card support member at the time of unloading (ejecting) the card.

5

In an unloading/loading unit provided with a wrong insertion protection groove in a typical card read/write device, it is particularly effective that a common member is used for dual purposes; the card support member to mate with the wrong insertion protection groove at the leading end of the card.

10

#### (Operation)

In the unit having the aforementioned configuration, when the card inserted through the card loading/unloading mouth is aligned by abutting the leading (insertion) end of the card against the support projections, the card holder retains the card by the retention means to be slid toward the connector in the read/write device for loading or ejected (unloaded) from the connector while supporting the card by the support projections when moved in the ejecting direction.

20

The card plugging arm pivotally disposed near the card loading/unloading mouth applies a linear driving force at the trailing edge of the inserted card to push in the card toward the connector. The slider engaging the plugging arm is slidable in the moving direction of the card and pivots to provide a driving force to push in the card at the trailing edge toward the connector. On the other hand, when the plugging arm pivots in the opposite direction, it disengages from the card away to the location not to interrupt the movement of the card.

25

30

The driving cam is controlled by the electrical driving member to operate the card holder and the slider in a predetermined sequence.

35

The plugging arm is equally energized from both sides of the card moving path, thereby avoiding biasing of the insertion force. Also, the plugging arm is pivotally supported on a rotary shaft perpendicular to the plane of the moving path of the plugging arm, thereby setting the pivoting plane of the plugging arm

40

in the same plane as the moving path. This allows the arm to engage at the trailing edge of the card. The use of the roller rolling about the axis parallel with the rotary shaft in engagement with the trailing edge of the card ensures smooth engagement and sufficient operation force.

The card inserted into the card holder receives side force by the torsion spring, thereby holding the card by a frictional force between the card holder. It is to be noted, however, that the frictional force is smaller than the force required for mating the card with the connector, thereby not mating the card with the connector by the movement of the card holder.

The driving cam has its rotary shaft at one side of the moving path to rotate by mating with the electrically driven pinion having teeth at the other side of the moving path, thereby providing a generally flat configuration. This allows the driving mechanism to be located at one face of the card. Additionally, the rotary shaft and the rotary shaft of the pinion are disposed symmetrically at both sides of the center line of the moving path at the central portion of the unit. The rotary shaft of the driving cam of the stacked 2 connector is coaxially disposed with the rotary shaft of the pinion, thereby making stacked individual loading/unloading units compact.

Additionally, when an operator attempts to insert the card up-side-down or from the trailing end by mistake, the reference projection provided to the card holder effectively prevents insertion of the card beyond the loading/unloading mouth. In other words, the reference projection enters into the wrong insertion protection groove only when the card is inserted normally. The leading edge of the card reaches the normal insertion detection means with no trouble, thereby pivoting the actuation arm to actuate the switch. In this manner, the initial condition of the electrically operated loading/unloading unit of the present invention is met.



Generally, in the card loading/unloading unit provided with the wrong insertion protection groove, the reference projection insertable into the wrong insertion protection groove acts as the card support member when  
5 ejecting (or unloading) the card.

(Embodiments)

Now, embodiments of the electrical loading/unloading unit of card media according to the  
10 present invention will be described in detail by reference to the accompanying drawings. Shown in FIG. 1 is a plan view of a principle part of a first embodiment of the unit according to the present invention. shown  
15 in FIGs. 2 through 4 are operation modes of the unit in FIG. 1. One of the features of the present invention is the card loading/unloading units for a pair of stacked card connectors are disposed at 180° different angle positions about the longitudinal axis inloading cards; thereby enabling to eject the cards individually.

20 In FIG. 1, motor 10, gear chains 12 and pinion 14, constitute a first card loading/unloading unit located at the upper side of the sheet of the drawing. On the other hand, motor 11, gear chains 13 and pinion 15  
25 constitute a second card loading/unloading unit located on the bottom side of the sheet of the drawing. In other words, the motor 11, the gear chains 13 and pinion 15 are located at the corresponding positions to the motor 10, the gear chains 12 and the pinion 14 rotated  
30 180° about the longitudinal axis M-M. The first and the second card loading/unloading units may be identical. As a result, only first card loading/unloading units will be described hereunder.

35 Represented by the reference numeral 16 is a driving cam pivoting about a fixed shaft 20 having a sector gear 18 to mate with the pinion 14, on the outer periphery. The driving cam 16 is formed with a holder transfer cam groove 22 and a plugging operation pin 24  
40 implanted therein. Represented by 26 is a card holder to receive the card therein and move the card. The card holder 26 has an operation pin 28 implanted therein to engage the holder transfer cam groove 22.

Represented by ~~30~~ is a reference projection formed at a corner to face the connector 34 at the left side edge 32 of the card holder 26. The reference projection ~~30~~ is disposed at a location to mate with a reference recess D for wrong insertion protection formed in the card C in advance when the card C is inserted normally.

Represented by ~~36~~ is a torsion spring to apply side pressure and extends inwardly from the opposite or right side edge 38. The torsion spring 36 enhances frictional force between the faces with the card holder for retention of the card.

Represented by ~~40~~ is a slider having a plugging operation cam groove 42 to engage the plugging operation pin 24 and a plugging arm driving cam groove 44 to reciprocally and linearly move by a guide groove 48 to be guided by two fixed pins 46.

Represented by ~~50~~ is a plugging arm pivotally supported to a fixed shaft 52 and has a function pin 54 pivot along the inner edge of the plugging arm driving cam groove 44 mated therewith and a roller 58 rotatably supported to a pivoting shaft 56. The connector 34 is vertically staggered but only upper connector is shown in the drawing for convenience of description. Represented by 60 are connection pins for making electrical connection with circuits in the card plugged to the connector 34.

Represented by ~~62~~ is a card insertion detection switch (S1) having an actuator 68. When no card C is inserted, the switch (S1) is normally pushed in by an operation lever 66 fixed to an operation arm 64 pivotally mounted in a coaxial manner with the driving cam 16. Represented by ~~70~~ is a loading completion detection switch (S2) which actuates the actuator 74 by a function member 72 provided at one side of the driving cam 16. Also, represented by ~~76~~ is an ejection (unloading) completion detection switch (S3) having an actuator 80 operated by a function member 78 provided at the other side of the driving cam 16.

In FIG. 1, when the actuator 80 of the ejection completion detection switch (S3) 76 is depressed by the function member 78, it indicates that ejection of the card has been completed and that the plugging arm 50 is in the free condition uninterrupted the path of the card. On the other hand, the actuator 68 of the card insertion detection switch (S1) is depressed by the function member 66 to indicate that the card C is not inserted or loaded yet.

10

Now, operation of this embodiment will be described by reference to FIGs. 2 through 4. FIG. 2 shows the card holder 26 with the card C normally inserted thereinto. The reference recess D for preventing wrong (or incorrect) insertion of the card C mates with the reference projection 30 in the card holder 26. This allows the insertion or leading edge 82 of the card C to abut against the support projections 84 of the card holder 26 to effect smooth ejection of the card C. The card C is then depressed to the left side edge 32 of the card holder 26 by the action of the side pressure torsion spring 36 for retaining the card C within the card holder 26.

25

Simultaneously, the function member 66 pressed by the roller 86 pivotally mounted at the end of the actuation arm 64 releases the actuator 68. However, when an operator tries to insert the card C up-side-down or from the trailing end, the reference projection 30 effectively prevents further insertion of the card C. As a result, no side pressure by the torsion spring 36 is applied to the card C for its retention and the roller 86 is not operated at the card insertion end 82, thereby not actuating the loading/unloading unit.

35

When the actuator 86 is released to actuate the card insertion detection switch (S1) 62, initial condition of the loading/unloading unit is met to make it in the stand-by condition. The motor 10 energized in accordance with card loading instructions from a control panel (not shown) or built-in program. The driving power of the motor 10 is transmitted to the pinion 14 by way of the gear chain 12. A sector gear 18 will cause

40

the driving cam 16 to pivot clockwise as shown by an arrow S in FIG. 2. An engaging edge 88 of the holder transfer cam groove 22 engages the actuation pin 28 implanted onto the card holder 26 to push it toward the connector 34. The card holder 26 moves together with the card C retained by a friction force until the card insertion edge 82 is proximity to the connection pins 60. The plugging operation pin 24 of the driving cam 16 is, then, movable in the plugging operation cam groove 42 in the slider 40.

The roller 86 of the actuation arm 64 moves from the peripheral edge of the card along the side edge 38 of the card holder 26 as the card C moves. As a result, the function member 66 of the actuation arm 64 does not actuate the actuator 68 until it returns to the initial condition.

As shown in FIG. 3, the actuation pin 28 is released from the engaging edge 88 in the holder transfer cam groove 22 to stop moving the card holder 26. At this time, the plugging operation pin 24 of the driving cam 16 abuts against the engaging edge 90 of the plugging operation cam groove 42 in the slider 40 to push it in the right direction (as shown by an arrow R).

This will cause the plugging arms 50 to pivot in the direction as shown by an arrow P in FIG. 3 by the action pin 54 inserted into the plugging arm driving cam groove 44.

The pushing rollers 58, then, abut against the trailing edge 92 of the card C to push the contact pins 60 into the pin holes in the card C (See FIG. 4). Since only friction force supports the card C in the card holder 26, the card transfer force by was of the card holder 26 in the initial condition is insufficient to provide the necessary insertion force of the card D and the connection pins 60. Accordingly, the means to push the card C at the trailing edge is effective for mating.

It is to be noted, also, that the card C is not sandwiched between rollers, thereby avoiding any possible adverse effects such as deformation or

disconnection due to compressive gripping force between rollers.

FIG. 4 shows the card C completely connected to the connector 34. This is the time when the motor 10 stops pushing the card C by the action member 72 of the driving cam to depress the actuator 74 of the loading completion detection switch ~~(S2)~~ 70.

Now, ejection or unloading of the card C will be described hereunder. In accordance with card ejection instructions from the control panel or built-in program, the motor 10 rotates in the reverse direction to the above mentioned card loading instructions. Similarly, the driving force of the motor 10 is transmitted to the pinion 14 by way of the gear chain 12 and pivots the driving cam 16 in the counter-clockwise as shown by an arrow S in FIG. 2 by the sector gear 18. The plugging operation pin 24 of the driving cam 16 freely moves in the plugging operation cam groove 42 in the slider 40 until abutting against the opposite edge 94 to the engaging edge 90. The actuation pin 28 implanted in the card holder 26 freely moves in the holder transfer cam groove 22.

The plugging operation pin 24 abuts against the engaging edge 94 to push the slider 40 and the plugging arms 50 are pivoted in the opposite direction as shown by an arrow P by the action pins 54 mated with the plugging driving cam grooves 44, thereby releasing the engagement between the trailing edge 92 of the card C and the pushing rollers 58 until the plugging arms 50 do not interrupt the moving path of the card C. Then, the actuation pin 28 engages the opposite edge 96 of the engaging groove 88 in the holder transfer cam groove 22 of the driving cam 16 to push the card holder 26 in the card ejection direction as shown by the arrow R.

The card holder 26 supports the insertion or leading edge 82 of the card C to bring it to a certain position that an operator can remove it manually. At the position of the card C, the action member 78 of the driving cam 16 pushes the actuator 80 to actuate the

ejection completion detection switch (S3) 76 to stop the motor 10. The card C can be removed to return the initial condition as shown in FIG. 1.

5 In this embodiment, a pair of plugging arms 50 are provided at both sides of the card C for pushing it. However, this is only for symmetrical design consideration and a single plugging arm 50 may be used at side from the functional point of view. Also, as  
10 shown in FIG. 1, the motor 10, the gear chain 12 and the pinion 14 are disposed at one side of the card and at 180 degrees about the longitudinal axis M-M and with respect to the motor 11, the gear chain 13 and the pinion 15 at the other side of the card C. However,  
15 since the pinions 14, 15 which are the final output members of the driving mechanisms are disposed at the center portion in the longitudinal direction of the loading/unloading unit and at one surface of the card C, the first and the second units may be the same and  
20 orthogonal to the longitudinal axis M-M to have the shafts of the pinions 14, 15 with 180° out of phase and centered about the axis T-T. In this instance, other elements of the first and the second units may be a mirror image about the boundary face of the two units.

25 Now, description will be continued on a second embodiment of the card holder for the electrical loading/unloading unit for card media according to the present invention by reference to FIG. 5. FIG. 5 is a  
30 plan view of only a portion relating to the card holder and the other components may be identical to those of the first embodiment. As a result, the same reference numerals are used to refer to the corresponding elements to the first embodiment.

35 It is typical to have reference recesses  $D_a$ ,  $D_b$  of different sized at both right and left edges of a card. On the other hand, wrong insertion protection projections to match the reference recesses  $D_a$ ,  $D_b$  and  
40 also to act as support projections to transfer the card C along with the card holder are provided at both edges. Reference numerals 530a, 530b are used in FIG. 5 to refer to such functional members.

Illustrated in FIG. 6 is a magnified view of the reference recesses  $D_a$ ,  $D_b$  in the card C with respect to the functional members 530a, 530b of the card holder 526. The functional member 530a is resilient to match the reference recess  $D_a$ , to push the card C toward the functional member 530b for enhancing frictional retention force of the card C by the card holder 526, and to latch at the left side edge of the card C at the step or shoulder  $N_a$ . On the other hand, the functional member 530b matches the reference recess  $D_b$  to latch the right side edge of the card C at step or shoulder  $N_b$ . However, the functional members 530a, 530b have a certain play in the thickness direction with the reference recesses  $D_a$ ,  $D_b$  when inserted therein to provide a certain freedom to the pin holes of various types of cards to the connection pins 60.

Typically, here are 3 types of cards C. FIG. 12 (a) shows a type I card C1, FIG. 12 (b) shows a type II card C2 and FIG. 12 (c) shows a type III card C3. As shown in FIG. 7 which is a cross section view of FIG. 5 along the line VII-VII, a pair of either type I or Type II cards C1, C2 are loaded in the stacked dual connectors 34 (FIG. 7(a)) or a single type III card C3 is loaded in the stacked dual connectors 34 (FIG. 7(b)).

The card holder 527, the actuation pin 29, and the functional members 531a, 531b with odd reference numerals correspond to the lower connector 34.

According to the card holders 526, 527 in the second embodiment having the functional members 530a, 530b; 531a, 531b, any type of the cards can be adapted to the stacked dual connectors 34. On the other hand, in a conventional card holder as shown in FIG. 8, when loading a type III card C3, the support projection 85 provide a normal function to the lower card holder 527 but the upper support projection 84 interfaces the hard case H above the card unless both upper and lower loading/unloading units are operated simultaneously. Accordingly, the card holder 526 according to the second embodiment is effective to provide versatility.

In the electrical loading/unloading unit for card media according to the present invention, mechanical loading the card by electric power will avoid any insertion or loading errors due to misalignment of the card C and the connectors, or foreign materials and dust entered in the unit. Biased insertion due to such errors, etc. would result in improper electrical connection, damages to the card, or degrade electrical signals.

FIG. 9 shows an accessory tool 900 to correct deformation of the connector pins 60. Represented by 901 is a correction jig of the connection pins 60 while 902 is a cleaning tool for the connection pins 60. Represented by 903 is a grip to make manual operation easier. The reference recesses  $D_a$ ,  $D_b$  are provided in the same manner as the normal card C. In FIG. 9, the tool 900 has both the correction jig 901 and the cleaning tool 902. However, they can be separated if desired.

FIG. 10 is a partial magnified view of the correction jig 901 and the connection pins 60. The correction jig 901 has an individual hole 904 for each connection pin 60 with a smoothly curved surface at each entrance 905. FIG. 10(a) shows how to correct the deformed connection pin 60a at the curved surface at the entrance 905. FIG. 10 (b) shows the connection pins 60 with the deformation corrected by the mating holes 904.

Illustrated in FIG. 11 is a magnified view of the cleaning tool made from a porous felt-like soft material. Grooves 902 wrap the connection pins 60 and repeatedly inserted into the unit to wipe off any dust or other foreign material collected on the connection pins 60. Preferably, any contact cleaning agent may be contained in the cleaning tool for improving the performance or lifetime by reducing insertion resistance.

#### (Advantages of the Invention)

As understood from the above description, the electrical loading/unloading unit for card media



according to the present invention features in the loading and unloading of the card by electrical power, especially ejection of the card by software from a computer program, thereby effectively preventing  
5 operation errors and leakage of confidential information or data.

Inserting or loading a card to the connection pins by pushing the trailing end of the card enables to  
10 provide a large insertion force and highly reliable loading of the card, thereby avoiding any damages which may be caused when gripped between rollers.

Also, since the final output members of the driving  
15 units are located on one surface of the card, the unit can be made in a compact design by disposing both units in a mirror image relationship with respect to the connector and disposing both driving devices at one side.

20 Additionally, the use of the functional members having both functions to the card holder to prevent loading in incorrect orientation and to latch the card during ejection enables to use the card holder commonly  
25 to all types of existing cards.

#### **BRIEF DESCRIPTION OF DRAWINGS**

30 FIG. 1 is a plan view of a first embodiment of the electrical loading/unloading unit for card media according to the present invention.

FIG. 2 is a plan view to illustrate the card holder  
35 in the first embodiment with a card to be loaded.

FIG. 3 is a plan view of the first embodiment to illustrate the operation.

40 FIG. 4 is a plan view of the connector in the first embodiment with the card completely loaded.

FIG. 5 is a plan view of a card holder in the second embodiment according to the present invention.

FIG. 6 is a magnified partial plan view to show the relationship between the card and the card holder of the second embodiment.

FIG. 7 is a front view along the line VII-VII in FIG. 5 to show the relationship of the card, the card holder and the connector.

FIG. 8 is a front view to illustrate the relationship of the card, the card holder and the connector in a conventional design.

FIG. 9 is a side view in partially cross section of a pin correction and cleaning tool for use with the present invention.

FIG. 10 is a magnified cross section side view of explaining the operation of the tool in FIG. 9.

FIG. 12 is perspective view of 3 types of cards.

FIG. 13 is a plan view of a conventional, manually operated card ejection unit.

**(Description of Reference Numerals)**

10, 11	motor
12, 13	gear chain
14, 15	pinion
16	driving cam
18	sector gear
22	holder transfer cam groove
24	plugging operation pin
26	card holder
28	action pin
30	reference projection
36	side pressure torsion spring
40	40 slider
42	plugging operation cam groove
44	plugging arm driving cam groove
50	plugging arms

	58	pushing rollers
	60	connection pins
	62	card insertion detection switch
	70	loading completion detection switch
5	72	unloading completion detection switch
	84	support projection

**CLAIM FOR PATENT**

- 5 (1) In loading and unloading a card media of a read/write apparatus for a card media, an electrical loading/unloading unit of a card media comprising:
- 10 card holder slidable in the moving direction of the card media and having support projections to abut against the leading edge of the card media to be inserted and retention means for retaining the card media;
- 15 card media plugging arm pivotally disposed near the insertion/extraction mouse of the card media;
- 20 slider slidable in the moving direction of the card media to engage said plugging arm;
- a driving cam to engage said card holder and said slider; and
- 25 electrical driving member for controlling said driving cam.
- 25 (2) The unit of claim 1, wherein said plugging arm is provided at each side of the moving path of the card media.
- 30 (3) The unit of claim 1 or 2, wherein a rotary shaft of said plugging arm is perpendicular to the moving path, and an engaging portion with the card media is a roller rotating about an axis parallel with said rotary shaft.
- 35 (4) The unit of either one of claims 1 through 3, wherein said retention means is a torsion spring extending into said card holder.
- 40 (5) The unit of either one of claims 1 through 4, wherein said driving cam has a rotary shaft at one side of said moving path to couple to a pinion having teeth at the other side for being driven electrically.

- 5 (6) The unit of claim 5, wherein said rotary shaft and the rotary shaft of said pinion are symmetrically positioned at both sides of a centerline of said moving path at the center portion of said unit.
- 10 (7) The unit of claim 6, wherein said read/write apparatus has two layer of connectors having the rotary shaft of the driving cam for one of said connectors being coaxial with the rotary shaft of the pinion for the other connector.
- 15 (8) The unit of either one of claims 1 through 7, wherein said card holder is provided with a reference projection at the upper stream of the support projections with respect to the moving direction of the card media, said reference projection being insertable into a groove at the leading end of the card media to prevent a wrong insertion.
- 20 (9) The unit of claim 8, wherein normal insertion detection means is provided to make it operable when the insertion end of the card media abuts against the support projections after matching the wrong insertion protection groove in the card media
- 25 inserted into said card holder and the reference projections.
- 30 (10) The unit of claim 9, wherein said normal insertion detection means is a switch ganged with an actuation arm pivotally mounted to the rotary shaft of said driving cam.
- 35 (11) The unit as defined in claim 1, 2, 3, 4, 5, 6, 7, 9 or 10, wherein the reference projection of said card holder matable with the wrong insertion protection groove at the leading edge of the card media is a card support member in unloading the card.
- 40 (12) In loading and unloading a card media having a wrong insertion protection groove of a read/write apparatus of a card media, a loading/unloading unit for card media characterized in that the card support member in unloading the card is a reference member to be

inserted into wrong insertion prevention groove provided at the leading edge of the card media.